XVII. TWO NEW SPECIES OF AGRIOCHŒRIDS.

By O. A. Peterson.

(Plates XIX-XX.)

During the past two seasons (1929-1930) field-parties from the Carnegie Museum in search of fossil mammalian remains in northeastern Utah, Mr. J. LeRoy Kay in charge, made a number of fortunate discoveries in horizon C of the Uinta Eocene. Among other things there were found a number of specimens representing the family *Agriochœridæ*, which furnish much welcome information as to the anatomical structure of species from the Uinta heretofore little known. All the material, representing new species, came from higher levels in horizon C than any previously discovered.

The study of this collection satisfactorily reveals:

(1) That the upper and lower jaw-fragments tentatively associated with fragments of the limbs and the foot-bones, described in 1919 as *Diplobunops matthewi* by Peterson,[1] are actually a part of the type.

(2) It is now quite clear that the genus *Diplobunops* does not belong with the *Anoplotheres* of Europe, except as a distant relative.[2]

(3) Some, possibly all, of the Upper Eocene Agriochœrids had the limb and foot structure well differentiated from other contemporaneous Protoreodonts.

(4) The structure of the limbs and foot underwent less change throughout the known cycle of the family *Agriochœridæ* than certain dental characters, namely the disappearance of the anterior intermediate cusp of the upper molars, the molarization of P_4, and other modifications of the teeth.

(5) The specialization of the upper and lower canines and the lower premolars of the Agriochœrids and Oreodonts are of such a deep-seated nature, that we should hardly look for its origin any later than the lower Bridger, or even earlier Eocene strata.

In a paper now being prepared by the author, the detailed description and illustrations of the osteological structure of the Upper Eocene Agriochœrids will appear, together with the discussion of the points above stated.

[1]Annals Carnegie Museum, Vol. XII, 1919, p. 76, Pl. XXXVIII.

[2]Peterson erroneously placed *Diplobunops* in the family *Anoplotheriidæ*. Ann. Carn. Mus., Vol. XII, 1919, p. 76.

Family AGRIOCHŒRIDÆ Leidy.[3]

1. **Diplobunops matthewi** Peterson.[4]

Type: Fragmentary skeleton including the greater parts of radius and ulna, portions of carpus and tarsus, No. 2,974, C. M. Coll.

Paratype: Fragments of skull and lower jaws, No. 3,394, C. M. Coll.

Horizon: Uinta Eocene. Horizon C, near base.

Locality: Six miles east of Myton, Uinta County, Utah.

Generic Characters: From material recently acquired by the Carnegie Museum the genus may now be characterized as follows: P^1 isolated by well defined diastemata. P^3 without distinct deuterocone, but with a heavy internal mass supported by strong root. P^4 with well developed deuterocone. Molars with anterior intermediate tubercles. Short and stout limbs; short and broad feet with high and laterally compressed unguals.

Specific Characters: The fragmentary condition of the skull, lower jaws and the dentition of the type specimen of *Diplobunops matthewi* permit of only partial comparison with specimens collected in strata over two hundred feet higher. However, in order to avoid the confusion which might later arise by associating the material under one species, I think it is preferable to present what few characters there are available pending the discovery of more complete specimens of *Diplobunops matthewi* from the lower level of horizon C. It is thus seen that the space for the premolar series on the alveolar border of the maxilla is slightly shorter, the deuterocone of P^4 smaller, and the depression on the muzzle immediately above P^1 shallower in *D. matthewi* than in the species *uintensis* from the later horizons. The specimens representing the two species are very nearly of equal size.

Measurements.	Paratype No. 3,394
Space between canine and M^1	50 mm.
Space for upper molars	40 mm.
Length of inferior molar series	45 mm.
" " M_1	10 mm.
" " M_2	15 mm.
" " M_3	21 mm.
" " P_3	10 mm.
" " P_4	12 mm.

[3]Journal of the Academy of Natural Sciences of Phila., Vol. VII, 1869, p. 131.
[4]Annals Carnegie Museum, Vol. XII, 1919, p. 76, Pl. XXVIII.

2. **Diplobunops uintensis** sp. nov.

Type: Skull, portions of two posterior lumbar vertebræ, one anterior caudal; the left fore-limb and foot; the greater part of the pelvis and the right femur. No. 11,769, C. M. Coll.

Horizon: Uinta Eocene; two hundred and fifty feet above the base of horizon C.

Locality: Green River, six miles above Ouray, Uinta County, Utah.

Specific Characters: Progressive elongation of the muzzle in the region of the premolars. Progressive development of the deuterocone of the posterior premolars, especially P^4. Twinned external median buttress on the molars.

THE SKULL. (Pl. XIX.)

It may be stated that the skull in *Diplobunops* departs slightly from the Eocene Protoreodonts by being relatively somewhat narrower and longer.[5] The nasals extend well forward and the occiput overhangs somewhat as in *Agriochœrus*. The sagittal crest of the newly discovered skull is broken off behind, but enough remains to determine that this element is high and rather thin. The postorbital process of the frontal is rather prominent, and in its crushed condition nearly meets the corresponding process of the jugal; the orbit is, however, not enclosed. The zygomatic process of the squamosal is thin and in the region of the glenoid articulation it is wider in the antero-posterior direction; it curves upward and outward, then rapidly inward, and terminates in a large, rounded process. The zygomatic process of the jugal is more rod-like. There are slight indications of lachrymal depressions. The exit of the infra-orbital foramen is above the anterior part of P^3. The nasals reach perhaps as far back as opposite the anterior border of the orbits. There is a noteworthy swelling of the muzzle opposite the diastemata and P^1. Immediately beneath this swelling and above the crown of P^1 there is a deep depression. The premaxillaries are mutilated, but enough remains to show that they were rather weak; the number of incisors of *D. uintensis* cannot be determined from the present specimen. The incisive foramen is nearly complete on the left side, of fairly large size, with the delicate spine which forms the internal border in place, terminating posteriorly

[5] In *D. uintensis* the skull is considerably depressed by crushing and thus gives a rather too broad, and faulty impression.

in a sharp point opposite P^1. The palate is of normal width and the posterior nares extend forward to opposite the anterior border of M^3. The base of the skull is considerably damaged. There is evidence of a tubular meatus in the relatively long region between the paroccipital and postglenoid processes. The structure of the skull in general suggests other contemporaneous Protoreodonts from the Uinta. The present specimen, as well as the type of *D. matthewi*, previously described, represent animals of approximately equal size to the type of *Protagriochœrus* described by Professor Scott, and are more than two-thirds as large as some of the largest forms (*e.g. Agriochœrus major*) of the Oligocene.

The canine is stout, long, recurved, sharply pointed, and in cross-section D-shaped, with the flat surface posterior, generally characteristic of the Oreodonts. P^1 is succeeded and followed by very decided diastemata. The tooth itself has not undergone the degree of reduction in size that one might expect when comparing it with the much reduced or absent P^1 in later representatives of the family. There is a curious deep pit on the side of the muzzle just above, or, one might say just at the alveolar border, which evidently must have so constricted the dental canal as to diminish the support for this tooth. The rest of the premolars and also the molars are remarkably similar to those of the Protoreodonts. P^2 has possibly advanced a stage beyond that in *Protagriochœrus*, the posterior portion of the body having developed a considerable spur, which continues from the protocone upward and backward to the postero-internal angle.

Except M^2 and M^3 of the left side, this series in the type is mutilated to a greater or less degree. The external median buttress on M^2 and M^3 is twinned, the bases of the twin-tubercles presenting inflation to an unusual antero-posterior extent, so that the region of the external buttresses, especially of M^3, might be better described by calling it a heavily serrated cingulum. The protoconule of the molars in this species may have undergone a still further reduction, when compared with Protoreodonts from the lower levels of horizon C of the Uinta.

MEASUREMENTS.

Length of skull, occiput to end of nasals*	225 mm.
Width of skull across zygomatic arches*	134 mm.
Width of muzzle at roots of canines	51 mm.

*Perhaps slightly exaggerated due to crushing.

Length of alveolar border..... 106 mm.
Length from anterior part of base of canine to and including M^3..... 103 mm.
Length of diastema, canine to P^2..... 27 mm.
" " premolars including diastemata..... 56 mm.
" " molar series..... 38 mm.

The Lumbar Vertebræ. The centra of the two last lumbar vertebræ are depressed, with no ventral keels, and the anterior face perhaps slightly more convex than the posterior. The base of the transverse process occupies the greater part of the side of the centrum, the process is thin and extends well out from the body of the vertebræ. The neural spines are also of considerable antero-posterior extent, but their height cannot be determined. Enough is left of the zygapophyses to determine that they have the characteristic double tongue and grooved articulations described in *Agriochœrus* by Wortman.

The Caudal Vertebræ. I judge the single caudal vertebra, which is all we have, to be the first. This bone has a well developed centrum with the usual convex anterior and concave posterior faces, strongly developed transverse process, a complete neural canal and well developed zygapophysis. In *Diplobunops* the tail was especially robust, and there is evidence that in the proximal region of the tail there were probably chevrons.

THE FORE-LIMB.

Scapula. The scapula is broader than in any Oreodont or Protoreodont known to me. What is known of the scapula in *Agriochœrus* appears to be more like that in the Oreodonts generally, and if correctly associated by Wortman,[6] is rather surprisingly different from that in *Diplobunops uintensis.* The scapula of the mounted skeleton of *Agriochœrus latifrons* (?) in the American Museum of Natural History, New York, illustrated by Matthew,[7] appears to have somewhat closer resemblance to that of the form under discussion.

The glenoid articulation of the scapula in the specimen being described has a subovate outline. There is a large coracoid, a short neck, a flaring blade and a prominent spine.[8] The acromion is partly

[6]See Wortman's description and illustration, Bull. Amer. Mus. Nat. Hist., Vol. VII, 1895, p. 152, Plate 1.

[7]Amer. Mus. Jour., XI, 1911, p. 162.

[8]Of four oreodont skeletons of different genera before me, one from the Oligocene and three from the Miocene, no scapula approaches the condition seen in *Diplobunops.* In *Promerycochœrus carrikeri* from the Miocene the blade is broad along the vertebral border, but the neck is long.

broken off, but, if complete, would no doubt extend at least even with the border of the glenoid articulation. In the region of the metacromion the spine is injured, but evidence of at least a small process is present. The spine is not entirely complete, but gives evidence of being as prominent as in most Oreodonts and divides the blade subequally, with the supraspinous fossa slightly the smaller of the two.

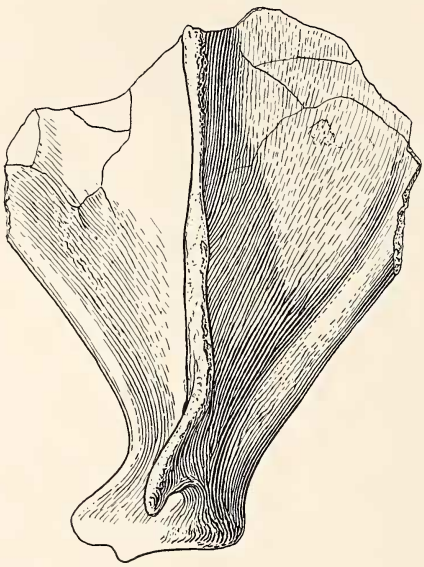

FIG. 1. External view of scapula of *D. uintensis* Peterson, No. 11,769. ½ nat. size.

The Humerus. The robustness of the humerus in proportion to its length is so vastly different from other Oreodonts, that I was at first inclined to regard the specimen as pertaining to two different individuals and possibly different genera. The humerus of this genus is only about one-fifth longer than that in *Protoreodon medius.*[9] The same measurements when compared with *Agriochœrus latifrons* as illustrated by Wortman[10] reveal the fact that the humerus of the Uinta form is between one-fourth and one-fifth shorter, while the transverse diameter at the distal end is very nearly equal to that in the spe-

[9]The type of *Protoreodon medius,* in the Carnegie Museum consists of the greater part of the skeleton and thus furnishes the most complete basis for comparison of any protoreodont known.

[10]Bull. Amer. Mus. Nat. Hist. Vol. VII, 1895, p. 154.

cies *A. latifrons* from the Oligocene. In the genus from the Uinta we have an unusually robust fore-limb. The head sits directly on the body of the shaft with little or no neck; posteriorly it slightly overhangs the shaft, which in part may be due to crushing. The detailed structure of the head is closely similar to that in *Agriochœrus*, except the lesser tuberosity, which appears to be relatively more robust. The greater tuberosity has the same, or nearly the same, shape and extent as that in the Oligocene genus, and the deltoid groove is similarly deep, wide, and single. The shaft of the humerus is very heavy; its internal border is rather thin, especially toward the internal condyle, from which point upward to the lesser tuberosity the border thickens and forms a decided outward curve. Between the very prominent deltoid crest and the internal border the shaft has a broad excavation extending down the shaft from the deltoid groove above to nearly the coronoid fossa below, unlike what is seen in any of the latter Agriochœrids or any of the Oreodonts known to me. In *Protoreodon medius* the

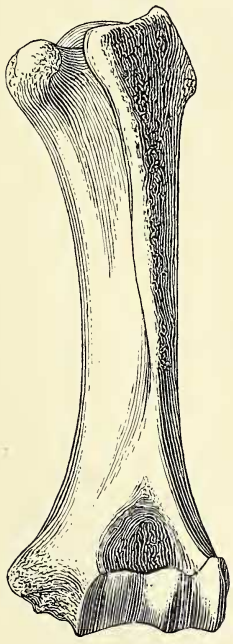

FIG. 2. Anterior view of left humerus of *D. uintensis* Peterson. Type, No. 11,769. ½ nat. size.

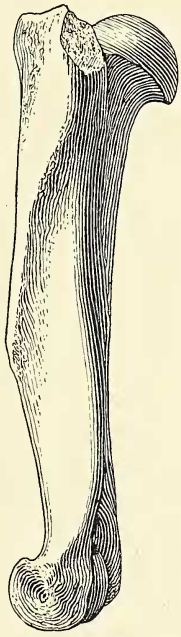

FIG. 3. Ulnar view of left humerus of *D. uintensis* Peterson. Type, No. 11,769. ½ nat. size.

FIG. 4. Front view of radius and ulna. Type of *D. uintensis* Peterson. No. 11,769. ⅔ nat. size.

deltoid ridge of the humerus extends further down on the shaft than in the Oligocene forms, but even here the shaft of the humerus has already attained the typical structure seen in later genera of the Oreodonts. According to Wortman's description and illustration, *l.c.*, pp. 153-154, the deltoid crest of the humerus in *Agriochœrus* reaches well down the shaft, but not to the extent seen in *Diplobunops*. The external and posterior faces of the shaft are more rounded, but the surfaces for the different muscles are distinctly marked by well indicated ridges. The anconeal fossa is low and broad, but not pierced by a foramen. The supinator ridge is prominent, but does not extend high up on the shaft.

The distal end of the humerus is more nearly like that in *Agriochœrus* and the European *Anoplotheres* (*Cf. Diplobune*) than any other mammalia, with which comparisons have been made. In the three different genera the internal portion of the articulating trochlea is larger than the external; the two being separated by a prominent intertrochlear ridge, which is more prominent than in bears; otherwise the trochlea suggests that of the Ursinæ, as was observed by Wortman. In fact the humerus in *Diplobunops* as a whole strongly suggests that bone in the bears.

MEASUREMENTS.

Humerus, total length	161 mm.
" greatest transverse diameter at head	48 mm.
" greatest antero-posterior diameter at head	43 mm.
" greatest transverse diameter of distal end	55 mm.
" greatest antero-posterior diameter of distal trochlea	18 mm.

Radius and ulna. The radius and ulna were found articulated and in their proper relative position. A section of the shaft of the radius was, however, missing, which was restored in plaster before the limb was removed from the matrix. The lower end of the shaft of the ulna was also badly preserved and was similarly restored, before the limb was removed from its original position in the rock. In this specimen we have thus the relative length of all parts of the fore-limb which was lacking in the type of *D. matthewi*. The length of the radius and ulna, when compared with those bones in *Agriochœrus* as described and illustrated by Wortman, are relatively short. In *Diplobunops* the shaft of the radius is on the whole smaller than that of the ulna, and proportionally smaller than in *Agriochœrus*. The shaft of the ulna presents longitudinal deep grooves upon its inner and outer sides

similar to what is seen in *Agriochœrus*, but more pronounced and extensive than in the latter genus. So far as can be determined from Scott's and Wortman's descriptions and illustrations, the articular surfaces of the radius and ulna of *Diplobunops* are quite similar to those in *Agriochœrus*.

In the specimen before me (No. 11,769) the olecranon process of the ulna is lost and the distal end is also injured, but in the type of *D. matthewi* these parts are preserved and have been described (*l.c.*, p. 77).

MEASUREMENTS.

Radius, greatest length	118 mm.
" " transverse diameter of head	28 mm.
" " antero-posterior diameter of head	14 mm.
" " transverse diameter of distal end	23 mm.
" " antero-posterior diameter of distal end	14 mm.

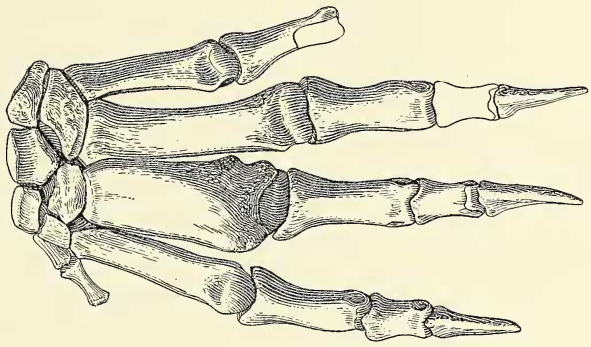

FIG. 5. Dorsal view of manus of *D. uintensis* Peterson, type, No. 11,769. Six-tenths nat. size.

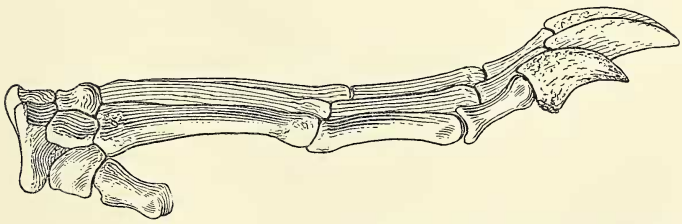

FIG. 6. Radial view of manus of *D. uintensis* Peterson, type, No. 11,769. Eight-tenths nat. size.

Manus. The fore foot was found articulated at the distal end of the radius and ulna. In comparing the carpal bones of the present

specimen with those found in the type of *D. matthewi* it is at once observed that these parts in the latter species evidently pertain to a larger individual, or that the carpus is proportionally larger in *D. matthewi.*

The manus in *Diplobunops* is short and broad. There is shown a pollux of considerable size, however, with perhaps only one phalanx. The distal articulations of the metapodials are rounded and like those of carnivores, but perhaps most similar to those in *Agriochœrus.* The terminal phalanges are high, compressed, and claw-like, as in the latter genus and the genus *Diplobune* of Europe.

In the carpus of the present specimen the different articular facets are indistinct, and therefore a detailed description, if here attempted, might be untrustworthy. Furthermore, the third metacarpal was evidently injured during the life of the animal, so that in its present state it is very much enlarged. The magnum, metacarpal two, and the trapezoid may be regarded as also slightly affected.

When the different elements of the forefoot are compared with the description of *Agriochœrus* by Wortman and Scott, general similarities are marked. However, the scaphoid in *Diplobunops* is perhaps broader; the beak of the lunar shorter, located more nearly in a middle vertical line, and, as a result, the distal articulations of that bone are more nearly of equal width and more horizontal with the unciform than in the specimens described by Scott, and especially that described by Wortman. The cuneiform is low, but has a close similarity to that bone in *Agriochœrus.* As in the latter genus the pisiform has a decided articulation with the lower end of the ulna as well as with the cuneiform. The trapezium is present, but some of its articular facets are rather indistinct, especially those for the trapezoid and metacarpal II. The facet for the scaphoid is oblique and articulated with what appears to be a corresponding surface on the radial palmar angle of the scaphoid. I judge that the trapezium articulated with the trapezoid and metacarpal II, as well as with the scaphoid and metacarpal I; there is a distinct and rather large facet for the latter. The bone upon the whole appears to be unlike those described by Scott and Wortman.[11]

Metacarpal I has an expanded head, on which is a large articulation

[11]The fore foot, especially with regard to the first digit and the problem of its opposability, will be taken up in a later publication, which will appear in the near future.

for the trapezium. The shaft is short, much constricted, and the distal end has an imperfect articulation, but there were undoubtedly one and possibly two phalanges. The metacarpals are short and stout, especially when compared with those in *Protoreodon*. In *Protoreodon medius*, described by Peterson,[12] metacarpal IV is complete and as long as in *Diplobunops*, but more delicate. In *Agriochœrus* the metacarpals are also apparently longer and slenderer. In an adult articulated skeleton of *Merycoidodon culbertsoni*, in the Carnegie Museum (No. 1,391) the carpus is of the same height as in the specimen being described, but narrower; the metacarpals are of equal length, but the shafts are thicker in the palmar-dorsal direction; the phalanges of the first and second rows are less depressed, but shorter, and the unguals are broader and shorter.

As stated above the terminal phalanges are characteristically like those in *Agriochœrus* of the American Oligocene and also of *Diplobune* of Europe.

MEASUREMENTS.

Carpus, greatest height—measured near radial angle of cuneiform	27 mm.
" " width	34 mm.
" length of m.c. IV	46 mm.
" " " proximal phalanx, digit IV	26 mm.
" " " median phalanx, digit IV	15 mm.
" " " terminal phalanx, digit IV	20 mm.
" greatest height of terminal phalanx, digit IV	10 mm.

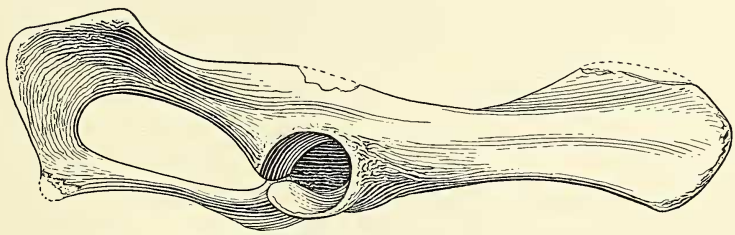

FIG. 7. *Diplobunops uintensis* Peterson. Right side of pelvis, type, No. 11,769, a trifle less than ½ nat. size,

THE HIND-LIMB.

Pelvis. When compared with other Oreodonts, the pelvis of *Diplobunops* is longer and more delicately constructed. According to the illustrations of *Agriochœrus* by Wortman (*l.c.*, pp. 164-165) the

[12](*l.c.* p. 82, Pl. XII).

femur is longer than the pelvis; while in *Diplobunops* the pelvis is the longer of the two, even when due consideration is taken of any slight crushing which may have occurred in the specimen under description. As in *Agriochœrus*, the transition into the expanded portion of the ilium is more gradual than in other Oreodonts, so far as known; and, while the superior portion of the border of the ilium is broken away in the present specimen, in *Diplobunops ultimus*, hereinafter described, it is observed that the gluteal surface is narrower than in *Agriochœrus*, and its posterior portion separated into two parts by a well marked ridge, as is also shown in *D. uintensis*. The region back of the acetabulum is relatively longer than in *Agriochœrus*, while posterior to the obturator foramen the whole structure in *Diplobunops* is less robust.

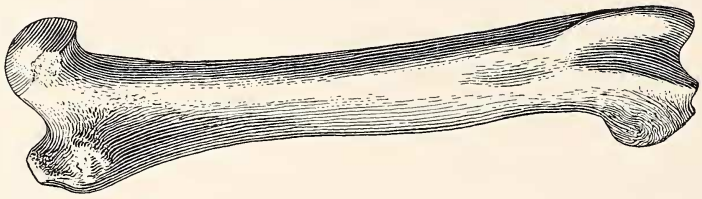

FIG. 8. Anterior view of right femur. Type of *D. uintensis* Peterson. No. 11,769, ½ nat. size.

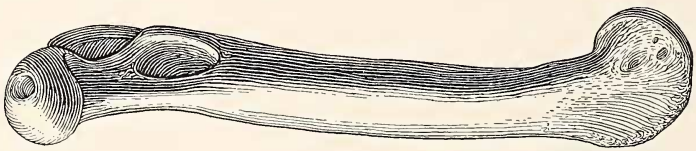

FIG. 9. Tibial view of femur of *D. uintensis* Peterson. No. 11,769, type, ½ nat. size.

Femur. The femur is relatively shorter and heavier than in *Agriochœrus*. In *Diplobunops* the head of the femur is well formed, has a longer neck, and is more carnivore-like than in the Oligocene genus. The greater trochanter appears to be approximately of the same proportion and in the same position as in *Agriochœrus*. The digital fossa is rather deep, narrow, and long. The lesser trochanter is well proportioned, and on its tibial face is a large excavation for muscular attachments; the shaft is heavy, trihedral in cross-section for the greater part of its length. The rotular trochlea extends well up; is rather narrow, and symmetrical, with the inner border the larger of the two, as observed in other genera. The antero-posterior extent

across from the rotular trochlea to the limit of the condyle is apparently as in *Agriochœrus*, and certainly of similar proportions to what is seen in other Oligocene Oreodonts.

MEASUREMENTS.

Pelvis, total length	210 mm.
Ilium from anterior border of acetabulum to extreme anterior end, approximately	108 mm.
Anterior border of acetabulum to end of ischium	113 mm.
Femur, total length	178 mm.
" transverse diameter at head	44 mm.
" transverse diameter at condyles of distal end	36 mm.
" transverse diameter of rotular trochlea	19 mm.

3. **Diplobunops ultimus** sp. nov. (Pl. XX).

Type: Part of skeleton with skull and lower jaws, No. 11,801a, C. M. Coll.

Paratype: Nearly complete vertebral column with ribs, limbs, and feet, together with fragments of skull, and lower jaws, No. 11,801 C. M. Coll.

Horizon: Uinta Eocene; approximately four hundred feet above base of horizon C.

Locality: Leota Ranch on Green River, six miles above Ouray, Uinta County, Utah.

Specific Characters. The chief specific characters of this species, distinguishing it from the preceding, so far as at present studied, are its relatively longer and slenderer muzzle and the advanced dentition of the cheek; that is to say the vertical pillar on the antero-internal angle of the protocone of P^4 is more distinctly developed than in *D. uintensis*; the external median buttress of the molars is single and rounded at the base, not unlike what is seen in *Agriochœrus minimus* Douglass, found in the lower Oligocene, at Three Forks, Montana. The molars of this species are of relatively greater antero-posterior and less transverse diameter than those in *D. uintensis*. In other words the molars of the present species have very nearly the same square proportions as those in *Agriochœrus* of the Oligocene. The anterior intermediate tubercle, however, still persists in this species found in the uppermost strata of horizon C of the Uinta Eocene. The smaller size of the canines in *D. ultimus* may well be a sexual character, which perhaps goes with the smaller size of the skull.

Full description and illustrations of this species will appear soon in the publications of the Carnegie Museum.

MEASUREMENTS.

Skull,	premaxillary to occipital condyle	195 mm.
"	premaxillary to M^3	107 mm.
"	canine to M^1	67 mm.
"	M^1 to M^3	39 mm.
"	M^3 to occipital condyle	92 mm.
"	transverse diameter at base of canines	39 mm.*
"	greatest transverse diameter including zygomatic arches	96 mm.*
"	transverse diameter of occipital plate	42 mm.
"	transverse diameter of occipital condyles	37 mm.

*Skull is crushed laterally, measurements may be slightly greater than in an uncrushed specimen.